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A new species of the genus *Anelpistina* (Insecta: Zygentoma: Nicoletiidae) from the Biosphere Reserve Sierra de Huautla

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Abstract.—The Biosphere Reserve Sierra de Huautla was established in 1999 in southern Morelos, Mexico, to protect the tropical dry forest that covers most of the region. From biodiversity studies performed in the reserve, a new species, *Anelpistina doradoi* was found and is described here.

Tropical dry forests (TDF), more than any other ecosystem in Mexico, suffer high rates of deforestation from humans, exceeding even those of the tropical rain forests (TRF). It has been estimated that the extension of land covered by TDF on the Pacific coast of Mesoamerica before the arrival of the Spaniards was approximately 550,000 square km (Janzen 1988). Today, only 2% of that forest remains intact (Janzen 1988), and the estimated current rate of deforestation for Mexico's TDF is around 1.9% annually, which translates to approximately 300,000 hectares per year (Miranda 1996). Within Mexico, the TDF is host to numerous endemic species of plants and animals, and consequently, its loss or misuse could result in a dramatic reduction of the biodiversity of the region. For example, it is estimated that approximately 40% of all plants found in TDF are endemic, whereas only 5% of plants found in Mexico's TRF are endemic (Dorado 2000). By the year 2010, the projected loss in number of species in TDF is between 6.8% and 13.06% (Monroy et al. 2000).

One of the least-studied groups of organisms affected by human activities and deforestation is the Zygentoma (Insecta) or "silverfish," which dwell in the soil and are of substantial ecological importance. In some areas of the Biosphere Reserve Sierra de Huautla, a TDF in southern Morelos, Mexico, silverfish make up to 60% of the macroarthropods found under rocks (pers. obs.). Despite their ubiquity throughout Mexico, however, they are poorly studied (Espinasa 1999a). Although 36 species of silverfish have been described in Mexico, this is but a small fraction of what must exist (Palacios-Vargas 2000), and of the species described, at least 17 (47%) can be found in TDF. Future research should uncover many new species. However, if the present rate of deforestation continues, many of these organisms may disappear and be lost to science forever. This work is a contribution to the knowledge of this fauna.

Materials and Methods

Specimens were collected under rocks and placed in 70% alcohol or taken alive to the laboratory. Dissections were made with aid of a stereo microscope and the different structures of the body were mounted in fixed-preparations with Hoyer's solution. All illustrations were made with a camera lucida attached to a compound microscope.

Types were deposited in the following collections: ♂ Holotype, 5 ♂ paratypes and 7 ♀ paratypes in LESM-DB-MEX (Laboratory of Ecology and Systematic of Microarthropods. Department of Biology, Faculty of Sciences, UNAM. Mexico D.F.).

Catalog numbers: ZYG-7. 11 ♂ paratypes and 3 ♀ paratypes are in author's collection at CEAMISH, UAEM.

Anelpistina doradoi, new species
Figs. 1–4

Type material.—México, Morelos, Tlaquiltenango municipality, Huautla ejido, tens of meters behind the Biological Station Sierra de Huautla at Cruz Pintada and the dam of Lorenzo Vásquez, 18°27′43.4″N, 99°02′07.6″W, Under rocks, 8 Jun 2000 and 22 Jul 2000, C. E. Granados-García and L. Espinasa cols. Male holotype, 16 ♂ paratypes, 10 ♀ paratypes.

Description.—Maximum body length 7.5 mm. Maximum conserved length of antennae 5.0 mm and of caudal appendages 3.5 mm. When complete, the antennae measure slightly more than half the length of body, and caudal appendages measure approximately half the length of body. Body proportions as in Fig. 1A. General color light yellow to white.

Basal article of antennae in males without projections. Pedicellus of antennae in adult male as in Fig. 1B, almost as long as 1st article and with unicellular glands clustered approximately in 3 groups, one of them very long. Pedicellus in juvenile male half as long as 1st article and with almost no unicellular glands (Fig. 1C). Female basal articles of antennae simple. Head with macrochaeta and microchaeta as in Fig. 1D, with approximately 8 + 8 macrochaetae on border of insertion of antennae.

Mouthparts relatively long, maxilla as in Fig. 1E. Last article of maxillary palp approximately ⅓ longer than penultimate. Apex of maxillary palp with 2 conules, one longer than wide and the other wider than long. Labial palp as in Fig. 1F, apical article barely longer than wide and only slightly longer than next to last article. Penultimate article with bulge containing 2 macrochaetae. Labium and 1st article of labial palp with macrochaetae. Mandibles without very small pegs on bigger tooth and chaetotaxy as in Fig. 1G.

Pro-, meso- and metanotum with approximately 5 macrochaetae on lateral borders apart from several setae of varied sizes, in (Fig. 2A). Legs as in Fig. 2B. Hind tibia approximately 5× longer than wide, slightly shorter than tarsus. Claws of normal size.

Abdominal terga and sterna as in other members of genus. Abdominal sterna II-VII subdivided into coxites and sternite. Sterna VIII and IX of male entire. Appendages of urosternum IV of adult male extremely long, similar to *A. carrizalensis* (Wygodzinsky, 1946) and *A. ruckeri* (Silvestri, 1905), but curved inward (Fig. 2E). Urosternum VIII of male long and shallowly emarginate on posterior margin (Fig. 3A–B). Urosternum IX of male as in Fig. 3A–B without a row of sensory cones or highly sclerotized submedian longitudinal macrochaetae. Behind insertion of parameres, in center, with a small group of short distinct setae. Point of insertion of parameres in urostermum IX is deep, and in adult, internal face of coxal processes with spiniform macrochaetae highly sclerotized. Stylets II–VIII as usual for subfamily. Stylets IX larger than others, with 2 macrochaetae and an extra subapical pair. Terminal spine with small teeth. In males and females styles without modifications. Urotergite X shallowly emarginated in both sexes, posterior angles with 2 + 2 macrochaetae and a few relatively strong setae, length of inner macrochaetae almost equal to distance between them (Fig. 3C).

Penis and parameres as in Fig. 3A–B. Parameres attaining slightly above ½ the length of stylets IX in adults. Surface of parameres with short setae. Subgenital plate of female rounded (Fig. 4A–C). Ovipositor in female adults surpassing apex of stylets I× by slightly less than 3× length of stylets (Fig. 4C). Gonapophyses with approximately 21 articles.

Cerci of adult male with a longer than wide basal article, sometimes followed by a wider than long, then a very long article bearing numerous spines, followed by nu-

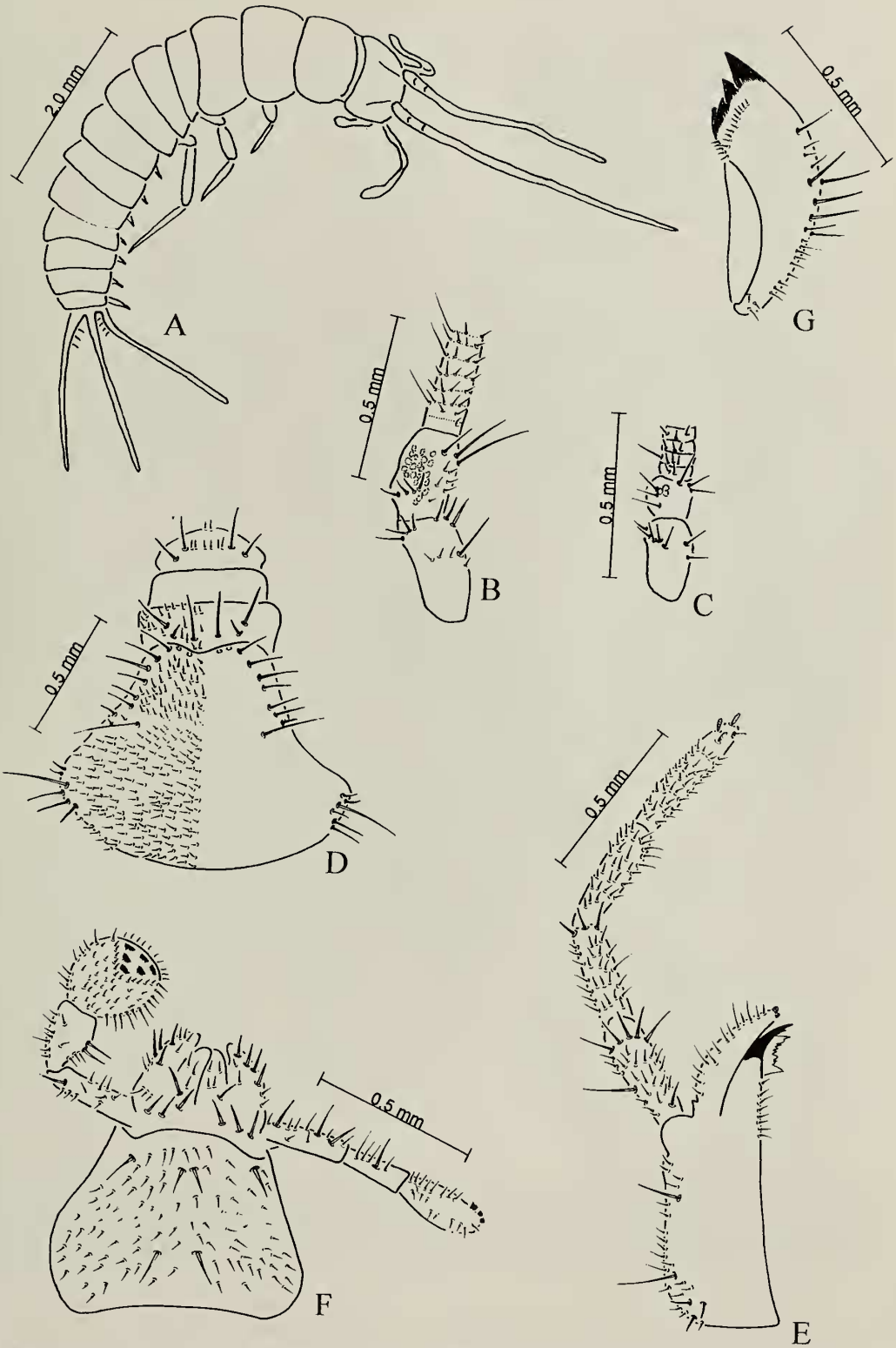

Fig. 1. *Anelpistina doradoi,* new species. A, Adult male paratype; B, D–G, Adult male holotype; C, juvenile male paratype; A, Dorsal view; B–C, Postembryonic development in male basal portion of antenna; D, Head; E, Maxilla; F, Labial palp and labium; G, Mandible.

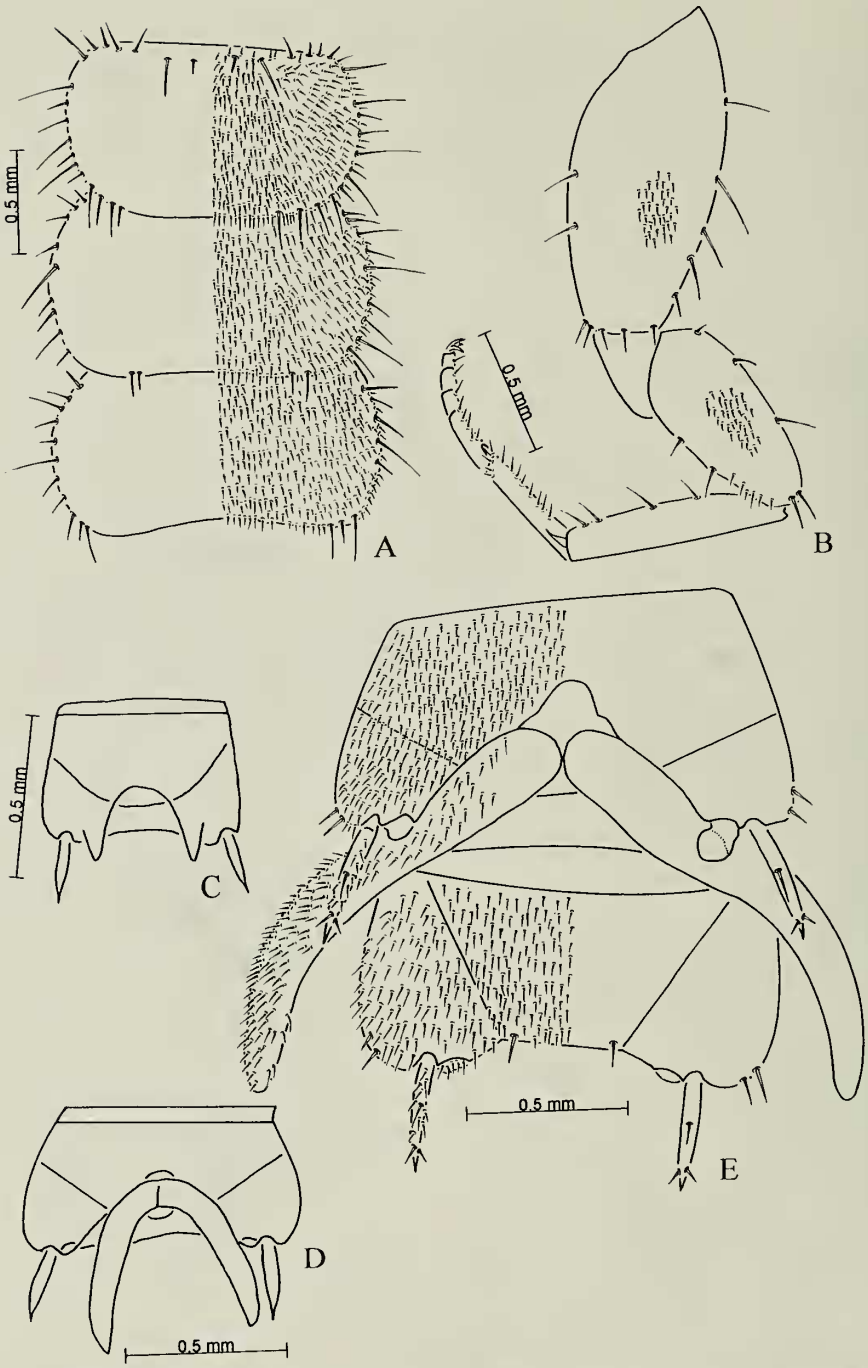

Fig. 2. *Anelpistina doradoi,* new species. A–B, E, Adult male holotype; C–D, Juvenile male paratypes; A, Thoracic nota; B, Hind leg; C–E, Postembryonic development in male appendages of urosternum IV.

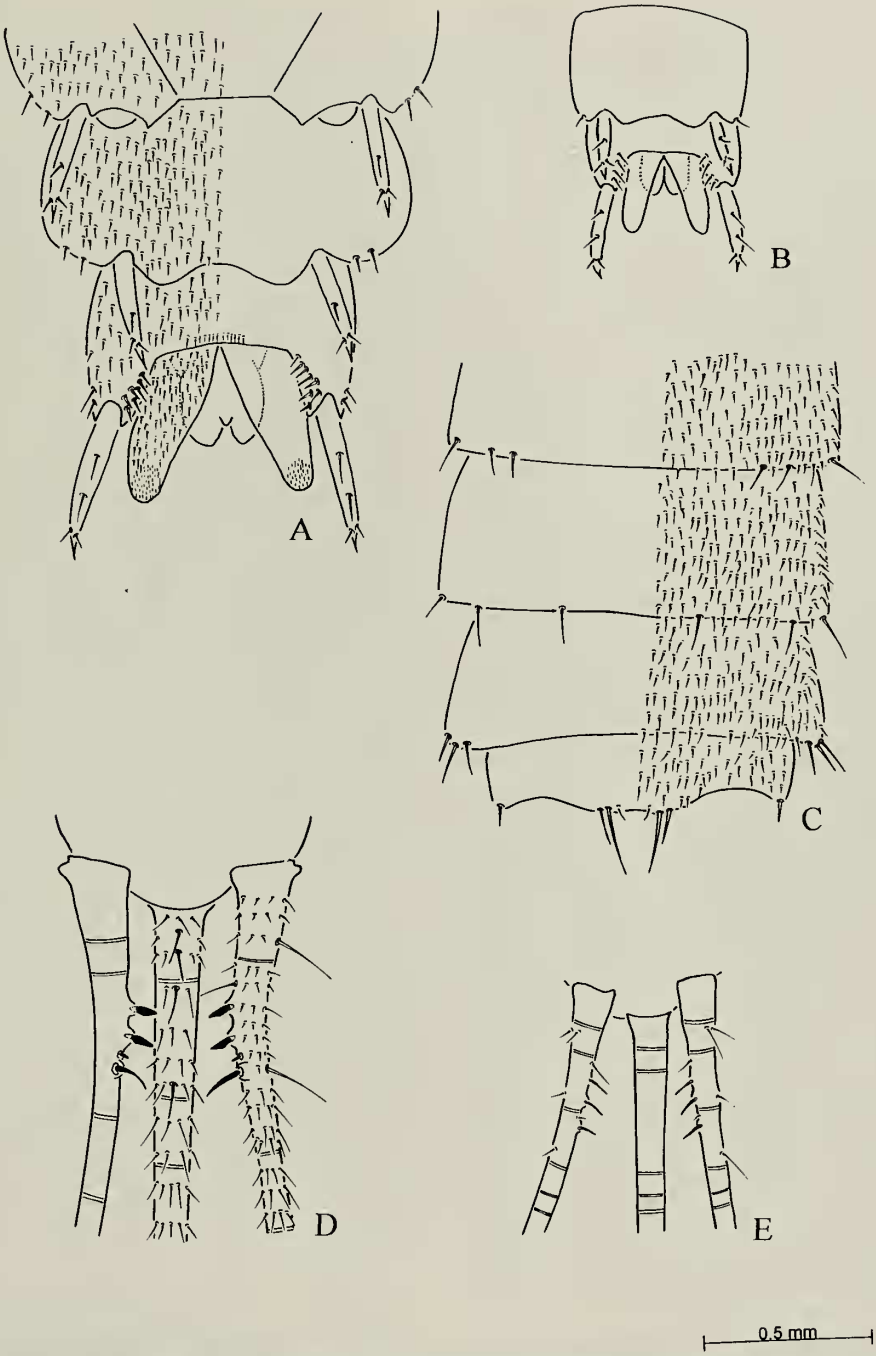

Fig. 3. *Anelpistina doradoi,* new species. A, C–D, dult male holotype; B, E, juvenile male paratype; A–B, Postembryonic development in male genital area; C, Apex of abdomen, dorsal view; D–E, Postembryonic development in male cerci.

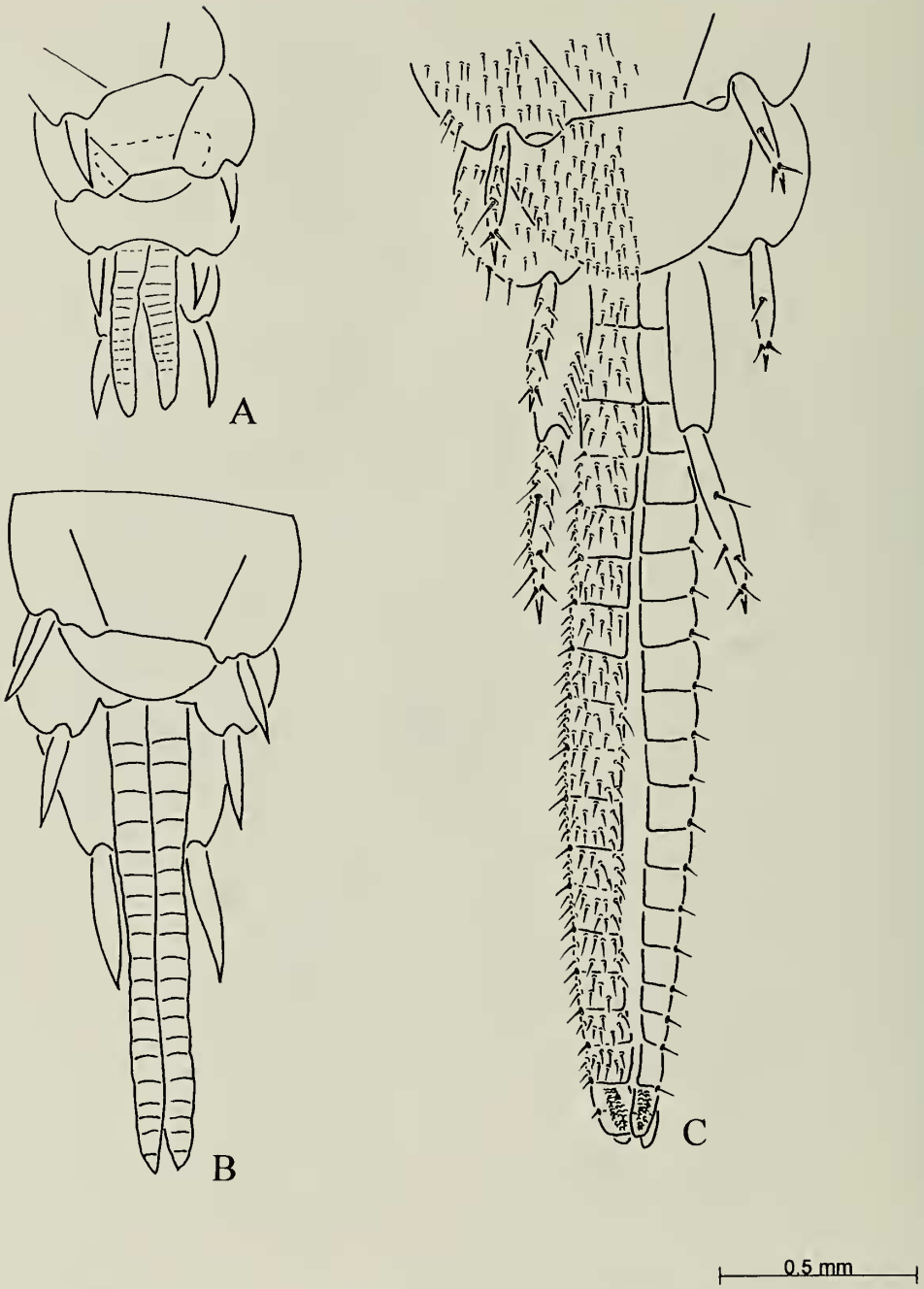

Fig. 4. *Anelpistina doradoi,* new species. A–C, Postembryonic development in female ovipositor and subgenital plate.

merous short articles of simple chaetotaxy. Spines consist of two strong, subacute ones inserted in tubercles, a very small one and a long, acute and slightly curved one (Fig. 3D). In some individuals, spines in cerci are asymmetrical; one of the cercus spines is as stated above and the other has 3 strong, subacute spines inserted in tubercles and

then the other two small and long ones. Female cerci simple.

Postembryonic development in male complex. In younger instars of less than 4.5 mm, the pedicellus of antennae half as long as 1st article and without unicellular glands (Fig. 1C), appendages of urosternum IV either absent or small (Fig. 2C), parameres attaining slightly below ½ of stylets IX (Fig. 3B), urosternum IX coxal processes without spiniform macrochaetae, and cerci without spines or spines slender and not highly sclerotized (Fig. 3E). Individuals of 4.5 mm to less than 5 mm acquire 4 spiniform macrochaetae highly sclerotized on the coxal processes of urosternum IX (Fig. 3B). Individuals of more than 5 mm progressively acquire the adult length of pedicellus and their unicellular glands (Fig. 1B), appendages of urosternum IV become of medium size (Fig. 2D) and then adult size (Fig. 2E), parameres attain slightly above 1/2 of stylets IX (Fig. 3A), urosternum IX coxal processes acquire 6 and then 8 spiniform macrochaeta (Fig. 3A), and the cerci attain the robust spines (Fig. 3D). The shortest male collected is 4.0 mm and the longest 7.5 mm.

In females, the length of ovipositor increases proportionally with body size. At a length of 3 mm, ovipositor barely surpasses base of stylets IX. At 4 mm, it reaches apex of stylets IX (Fig. 4A). Longer body sizes of up to 7 mm bring an increase of size (Fig. 3B) until ovipositor surpasses apex of stylets IX by slightly less than 3× length of stylets (Fig. 3C). The shortest female collected is 3.0 mm and the longest 7.0 mm.

Range.—Known only from the type locality.

Etymology.—The species is named for Dr. Oscar Dorado, Director of the Centro de Educación Ambiental e Investigación Sierra de Huautla (CEAMISH) at the Autonamous University of the State of Morelos (UAEM), to recognize his efforts in establishing Sierra de Huautla, the type locality of this new species, as a biosphere reserve.

Remarks.—Adult males of Anelpistina can be easily subdivided by the morphology of the appendages of urosternum IV (Fig. 2C–E). *Anelpistina decui* (Wygodzinsky & Holinger 1977) and *A. inappendicata* (Espinasa 1999b) lack them. In *A. weyrauchi* (Wygodzinsky 1959), the medium-sized appendages have a small subapical projection on outer margin, and two projections at both sides of insertion of stylets. Adults of *A. anophtalma* (Bilimek 1867), *A. wheeleri* (Silvestri 1905), *A. miranda* (Silvestri 1912), *A. boneti* (Wygodzinsky 1946), *A. bolivari* (Wygodzinsky 1946), and *A. cuaxilotla* (Espinasa 1999b) have simple appendages of medium size, their length being slightly longer than the length of urosternum IV and less than 5× longer than wide. *Anelpistina ruckeri* and *A. carrizalensis* have simple appendages of very long size, their length being approximately equal to twice the length of urosternum IV and more than 6× longer than wide. To this last group belongs the new species, but it can be differentiated from *A. ruckeri* and *A. carrizalensis* because in both species appendages of urosternum IV are curved outward and urotergite X is deeply emarginated on the posterior border, while only in the new species appendages are curved inward (Fig. 2E) and urotergite X is only shallowly emarginated (Fig. 3C).

Furthermore, the new species can be differentiated from other congeners by its particular set of spines on cerci. While *A. wheeler, A. ruckeri* (although not shown in Silvestri's 1905 drawings), *A. carrizalensis* and *A. inappendicata* have nine or more spines of subequal size, and *A. decui, A. weyrauchi, A. anophtalma, A. miranda, A. boneti, A. bolivari,* and *A. cuaxilotla* spines consist basically of a long, acute and slightly curved one inserted in a tubercle, a very small one, a strong, subacute one inserted in tubercle, and sometimes a fourth very small one, the new species has the same three distal spines, but then instead of no spine or a very small one, it has another one or two strong, subacute ones inserted in tubercles (Fig. 3D).

Females are more difficult to differentiate within the genus, and the change in length of the ovipositor on the postembryonic development might cause confusion. For the new species, ovipositor in female adults surpasses apex of stylets IX by slightly less than thrice the length of stylets (average of 2.72 times in females measuring 7 mm, range from 2.6–2.8, $n = 3$) and gonapophyses with approximately 21 articles. *A. weyrauchi* has a much longer ovipositor (surpasses 5×) with 30 articles. Every other species with the exception of *A. wheeleri* and *A. miranda* have in different degrees, smaller ovipositors with fewer articles. Females of *A. ruckeri* have not been described.

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